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PERINATAL MORTALITY AND LOW BIRTHWEIGHT BY AGE, PARITY AND SOCIO-ECONOMIC BACKGROUND: EVIDENCE FOR IRELAND

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1. Introduction

Studies for Britain and other developed countries have found perinatal and infant mortality to be closely linked with socio-economic background, and this has been an important element in the wider literature on health inequalities.[1] As far as perinatal deaths are concerned, particular interest has been shown in disentangling the effects of socio-economic background from those of mother's age and parity.[2] This paper presents new evidence on the relationship between the perinatal mortality rate and mother's age, parity and socio-economic group in Ireland. The data are produced by a perinatal reporting system introduced in the early 1980s and now covering all births: here figures for the five years 1984-88 are employed. A logit model is estimated to show the way in which perinatal mortality is related to age, parity and socio-economic background, and how these factors interact.

Low birthweight, an important influence on health in later life, has also been found to be related to socio-economic background.[3] Using the perinatal database, we go on to examine the relationship between low birthweight and the same factors.

The results show statistically significant effects of all three factors on both the perinatal mortality and low birthweight rates. The risk of perinatal mortality is highest where the father is an unskilled manual worker or unemployed, and this effect is most pronounced where the mother is aged 35 or over. Low birthweight is most prevalent for mothers from that socio-economic background aged under 20.

2. The Data

The data to be employed are produced by a perinatal reporting system introduced in Ireland in the early 1980s. This forms part of the birth registration procedure, whereby all births are registered and notified using a standard form which contains information on, inter alia, birthweight and gestation period, mother's age, marital status and parity, father's occupation, perinatal care, perinatal outcomes, and cause of death where relevant. These forms are coded and checked by the Department of Health, computerised by the Central Statistics Office, and

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[1] See for example Antonovsky and Bernstein (1977) for a survey of evidence across developed countries, and OPCS (1985) for recent British figures.

[2] See for example Murrell *et al* (1985), OPCS (1985), Adelstein *et al* (1980).

[3] See Dowding (1981) for an earlier study of the relationship between low birthweight and socio-economic status using Irish data. On the relationship between low birthweight and health outcomes see for example Institute of Medicine (1985), Schwartz (1989).

form the basis for the annual report on Perinatal Statistics issued since 1984 by the Department of Health (see Department of Health 1988 for the most recent report).

Standard definitions of live birth, still-birth and early neonatal death (ie death of a live-born infant within the first week) are employed, following WHO guidelines.[4] Parity refers to the mother's number of previous live plus stillbirths. The categories for mother's age and parity to be employed here are:

Mother's age: under 20, 20-24, 25-34, 35 and over;

Parity: 0 previous births, 1 previous birth, 2 previous births, 3 or more previous births.

Socio-economic status is based on information obtained about the father's occupation. This is coded and grouped according to the Irish Central Statistics Office's system of socio-economic groups (SEGs), with minor modifications. This system, like the corresponding SEG categorisation employed by the UK CSO, is intended to group together persons (and their dependants) with generally similar occupations as regards the level of skill or educational attainment required.[5] It is not possible at present to take into account mother's occupation or to categorise by social class rather than SEG, though revision of the registration form to collect information which would make this possible is under consideration. The relatively low labour force participation rate of married women in Ireland means that mother's occupation is less important than it may be elsewhere. Unlike social class, SEG is not designed to provide a ranking in terms of socio-economic status, so for example all farmers are allocated to the same SEG irrespective of farm size. Nonetheless, by distinguishing those in professional/managerial, intermediate non-manual, skilled,semi-skilled and unskilled manual occupations it serves as a good indicator of socio-economic status for most of the population, and has been quite widely employed internationally in the analysis of mortality differentials.[6]

The CSO use a 12-point SEG scale, the final category being "Unknown", which includes those where the occupation has been stated as unemployed and no previous occupation given. In the perinatal reporting system the unemployed are shown as a separate group, distinguished from cases where the information was insufficient, or where no information was provided.[7]

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[4] For the precise definitions employed see Perinatal Statistics 1988 pp.10-11. In line with WHO guidelines, infants weighing less than 500 grammes are not included in the statistics.

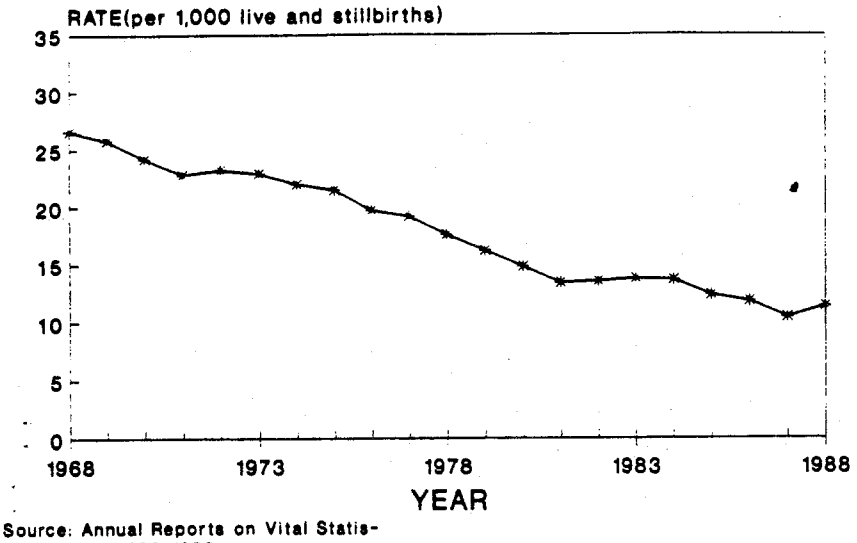
[5] See Census of Population 1981 vol. 7, p. viii.

[6] For example, the OPCS Decennial Supplements on Occupational Mortality include categorisation by both SEG and social class (OPCS 1986). Nolan (1990) analyses mortality among adult males aged 15-64 for Ireland by SEG. O'Hare, Whelan and Commins (1991) discuss the relationship between the SEG system used by the Irish CSO and social class, and describe the development of the 6-point social class scale recently introduced by the CSO.

[7] The published statistics also use mother's marital status is used to distinguish cases where no information is given and the mother is married from those where she is single, widowed, divorced or separated.

FIGURE 1

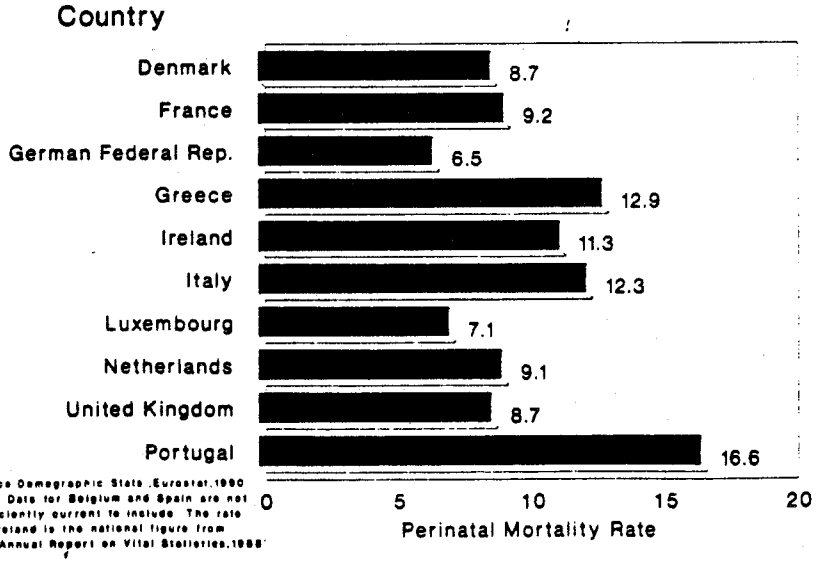
PERINATAL MORTALITY RATE, IRELAND: 1968-1988



Source: Annual Reports on Vital Statistics, Ireland:1968-1988.

FIGURE 2

PERINATAL MORTALITY RATES, 1988 FOR EC COUNTRIES



Source Demographic Stats.,Eurostat,1990
Note Data for Belgium and Spain are not sufficiently current to include. The rate for Ireland is the national figure from the 'Annual Report on Vital Statistics,1988'

Here SEGs are combined to form the following five categories:

i) Farmers, farm labourers and fishermen
ii) Professional/managerial
iii) Intermediate non-manual
iv) Skilled/semi-skilled manual
v) Unskilled manual/unemployed.[8]

The published statistics include the perinatal mortality rate classified by mother's age, by parity, and by socio-economic group separately. However, since mother's age, parity and socio-economic background are related to each other, to explore their influence on perinatal mortality we must make use of the individual-level data. This also allows the factors associated with low birthweight to be analysed. We confine our attention to singleton births, since the analysis of birthweight in particular would be complicated by inclusion of multiple births. While the number of perinatal deaths in any one year is quite small - about 400 stillbirths and 200 early neonatal deaths - we can make use of data for the five years 1984-88 taken together. Cases were omitted where information was missing on one of the independent variables, which arose most often for socio-economic group, particularly for single mothers. On this basis, 255,202 births, about 87% of all (singleton) births reported, can be included in our analysis.[9] Of these, 1856 were still-births and 1044 were early neonatal deaths.

3. Perinatal Mortality

The perinatal mortality rate in Ireland has fallen dramatically from 30 per 1,000 live and stillbirths in 1965 to 11 per 1,000 in 1988 (Figure 1). The Irish rate is now slightly higher than that in some of the richer EC countries such as Germany, Denmark, The Netherlands or the UK, but lower than those of Greece or Portugal (Figure 2).

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[8] These consist of the following SEGs as defined by the CSO: i) is SEG 0 farmers, farm relatives and farm managers, and 1 other agricultural occupations and fishermen; 11) is SEG 2 higher professional, and 3 lower professional; iii) is SEG 4 employers and managers, 5 salaried employees, 6 intermediate non-manual, and 7 other non-manual; iv) is SEG 8 skilled manual and 9 semi-skilled manual; and v) is SEG 10 unskilled manual plus the unemployed in SEG 11. For a full description of the SEGs and the coding of occupations see Census of Ireland 1981 volume 7 (1986), Appendix B. For the coding in the perinatal reporting system see Perinatal statistics 1988 Appendix B.

[9] In 1984 the perinatal reporting system covered 94% of all births in the State, while for subsequent years the coverage was complete.

The data for singleton births 1984-88 to be employed in this paper show a perinatal mortality rate over that period of 11.4 per 1,000 births (live plus stillbirths). Table 1 shows the way in which births and perinatal deaths are distributed, and how the perinatal mortality rate varies, by each of the three variables on which we are concentrating, that is, mother's age, parity and socio-economic background. The perinatal mortality rate is seen to be higher when the mother is aged under 20 or over 34 than when she is aged 20-34, when she has had no previous birth or 3 or more births rather than 1 or 2, and when the socio-economic group is unskilled manual/unemployed rather than any of the other four categories.

Table 1: Perinatal Death Rate by Mother's Age, Parity and Socio-Economic Group, Ireland 1984-88

A/ : Perinatal Death Rate by Mother's Age

	births	perinatal deaths	perinatal death rate (per 1000)
under 20	4139	55	13.288
20-24	43031	447	10.388
25-34	161697	1671	10.334
35 and over	46335	727	15.690
all	255202	2900	11.364

B/ : Perinatal Death Rate by Parity

number of previous births	births	perinatal deaths	perinatal death rate (per 1000)
0	64914	799	12.309
1	69656	606	8.700
2	51473	482	9.364
3 and over	69157	1013	14.648
all	255202	2900	11.364

C/ : Perinatal Death Rate by Socio-economic Group

	births	perinatal deaths	perinatal death rate (per 1,000)
farmers/farm labourers	33456	346	10.342
professional	22903	211	9.213
other non-manual	88128	900	10.212
skilled/semi-skilled manual	83080	910	10.953
unskilled manual/unemployed	27635	533	19.287
all	255202	2900	11.364

However, these gross relationships between perinatal mortality and the three factors of interest must be interpreted in the light of the fact that age, parity and socio-economic status are not independent. Parity is clearly related to age, with the number of previous births increasing on average with the age of the mother. Thus, 71% of mothers aged under 20 had no previous birth, compared with 46% of those aged 20-24, 24% of those aged 25-34, and only 7% of those aged 35 or over. Conversely, only 1% of those aged under 20 had 3 or more previous births, compared with 5% of those aged 20-24, 23% of those aged 25-34, and 63% of those aged 35 or over. Mother's age and parity are also related to social class. As Table 2 shows, a relatively high percentage of births in the unskilled manual/unemployed group are to mothers aged under 20 or 20-24, while the professional/managerial and especially the farmers categories have low proportions in those age groups and a high proportion born to mothers aged 35 and over. Similarly, there are significant differences across the socio-economic groups in the distribution of births by parity: 36% of births in the farmers category and 41% of those in the unskilled manual/unemployed category are to women with 3 or more previous births, compared with only 18% for the professional/managerial and 25% for the intermediate non-manual and skilled/semi-skilled manual groups.

Cross-classification of perinatal mortality rates by two or by all three of the factors of interest is helpful in exploring the importance of the different factors. For example, Table 3 shows the cross-classification by age and socio-economic status. We can see that the rate for the unskilled manual/unemployed group is consistently higher than that for other socio-economic categories **within** age groups, so differences in mother's age do not fully explain the fact that the overall rate for that socio-economic category is so high. It also reveals that the perinatal mortality rate for the sub-group who are both in the unskilled manual/unemployed category and the 35 or over age group is extremely high, at 35 per 1,000 compared with the average for that socio-economic group of 19 and the overall average of 11.4. The role of parity can then be taken into account by the full three-way cross-classification, which is shown in Appendix Table 1. This again is useful in showing, for example, that the perinatal mortality rate for the unskilled manual/unemployed group remains consistently high within both age and parity categories, and is particularly high for the 35 or over age group irrespective of parity.

Table 2: Births by Socio-economic Group and Mother's Age (%)

%	under 20	20-24	25-34	35 and over	all
farm	1.0	11.4	60.0	27.6	100.0
professional	0.3	5.8	72.5	21.4	100.0
other non-manual	1.2	15.6	65.4	17.8	100.0
skilled/semi-skilled	1.8	20.4	63.3	14.6	100.0
unskilled/ unemployed	4.3	26.1	53.6	15.9	100.0
all	1.6	16.9	63.4	18.1	100.0

Table 3: Perinatal Death Rate by Socio-economic Group and Mother's Age

	under 20	20-24	25-34	35 and over	all
farm	2.890	9.436	10.064	11.601	10.342
professional	0	12.140	8.728	10.181	9.213
other non-manual	14.437	8.881	9.281	14.513	10.212
skilled/semi-skilled	12.072	10.091	10.104	15.715	10.953
unskilled/ unemployed	17.471	14.135	17.414	34.538	19.287
all	13.288	10.388	10.334	15.690	11.364

However, inspection of such cross-tabulations has clear limitations if the aim is to quantify and compare the contribution of the different factors and assess their statistical significance. In particular, As Murrell et al (1985) point out in this context, the wide variation across the cells in the number of births underlying the mortality rates means that one can be mislead by large differences in rates based on few births, or ignore relatively small differences based on many births. We therefore wish to fit a statistical model to the individual data. The dependent variable is dichotomous, taking the value 1 in the case of perinatal deaths and 0 otherwise. We fit the logit model, based on the cumulative logistic probability function, which involves

transforming the dependent variable to the log of the odds of the event in question occurring. This model is widely used for the analysis of dichotomous dependent variables, and ensures that the predicted probabilities - in this instance the risk of perinatal death - will lie within the 0 - 1 range.[10]

The independent variables are all categorical, entered in the form of dummy variables. The model is estimated using maximum likelihood methods, and the results are shown in Table 4. In column (1), main effects only are included in the model - that is, the age, parity and socio-economic group categories without interaction terms. The omitted categories reflected in the intercept are age 20-24, parity 2, and the farmers etc. socio-economic group. The estimated coefficients on age 35 or over, parity 0, parity 3 or more, and occupational groups skilled/semi-skilled manual and unskilled/unemployed are all significant and have the expected positive sign - that is, compared with the omitted categories each of these characteristics is associated with a higher probability of perinatal death.

Before looking at the magnitude of these estimated effects, the generalisation of the model to include interaction terms will be discussed. Models which included different sets of two-way and three-way interactions between the independent variables, and a full or saturated model which included all such interactions, were also estimated. In addition to t-tests on individual coefficients, various sets of interactions were examined for statistical significance using likelihood-ratio tests. These tests indicated that the set of two-way interactions between age and occupation added significantly to the explanatory power of the equation.[11] Further testing showed that in fact one particular term, namely the interaction between age 35 and over and the unskilled manual/unemployed socio-economic group, was responsible. Column (2) shows the estimated model with main effects and this additional explanatory variable, which is clearly significant. Some of the main effects terms remain insignificant, and col. (3) shows the estimated model when these are omitted. This shows that that the characteristics being aged 35 or over, having no previous children, having three or more previous children and being in the skilled/semi-skilled or unskilled/unemployed socio-economic group are all statistically significant predictors of a perinatal mortality rate higher than that for the omitted categories. In addition, being both aged 35 or over and in the unskilled/unemployed group is associated with an even higher probability than their separate coefficients would suggest - the interaction term is significant and positive.

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[10] Use of the logit model with categorical independent variables is closely related to log-linear analysis of contingency tables, see Murrells et al (1985), Hanushek and Jackson (1977) Ch. 7.

[11] The the log-likelihood value for the estimated equation with all two-way interactions betwen age and occupation was -15690, compared with -15703 for the model with main effects only shown in Col. (1). Twice the difference in the log-likelihoods, 26, exceeds the critical value in chi-squared distribution (5% level) with 12 degrees of freedom, that being the difference in number of parameters between the model with and without these interactions, so they jointly add significantly to the explanatory power of the equation. When the set of interactions between age and parity are added to the main effects the log-likelihood value is -15701, and for those between occupation and parity it is -15696, neither of which pass this test, nor do sets of three-way interactions.

Table 4: Estimation Results for Logit Model, Perinatal Deaths

independent variable	Model (1) coefficient (t-statistic)	Model (2) coefficient (t-statistic)	Model (3) coefficient (t-statistic)
intercept	-4.98 (61.95)	-4.94 (61.12)	-4.85 (130.88)
age under 20	0.08 (0.56)	0.10 (0.68)	-
age 25-34	0.09 (1.58)	0.08 (1.36)	-
age 35 or over	0.46 (6.66)	0.38 (5.18)	0.31 (5.89)
parity 0	0.38 (6.98)	0.38 (6.89)	0.36 (7.58)
parity 2	0.02 (0.30)	0.02 (0.40)	-
parity 3 or more	0.32 (5.66)	0.32 (5.70)	0.32 (6.75)
professional	-0.07 (0.80)	-0.75 (0.84)	-
inter. non-manual	0.05 (0.78)	0.04 (0.65)	-
skilled/semi skilled manual	0.14 (2.16)	0.13 (1.98)	0.11 (2.54)
unskilled/ unemployed	0.69 (9.82)	0.59 (7.60)	0.56 (9.41)
age 35 or over+ unskilled/ unemployed	-	0.36 (3.31)	0.37 (3.42)
number of observations	255,202	255,202	255,202
log-likelihood	-15703	-15698	-15700
Chi-squared	329.32	339.95	335.55

Note: Omitted categories reflected in intercept are age 20-24,parity 1, farmers etc.

To see the size of these estimated effects, we can calculate the predicted probability of perinatal death, and thus the perinatal mortality rate, for any combination of the independent variables. (This involves converting the figure calculated from the estimated equation, which is predicted log(p/1-p), to the implied value for p). These results are shown in Table 5. In the case of a mother aged 20-34, parity 1 or 2, and occupation farmer/professional/other non-manual, the predicted log(p/1-p) from the equation is simply the intercept, which converts to a value of 0.008 for p, or a perinatal mortality rate of 8 per 1,000. If the only change in characteristics from this benchmark is that the mother is aged 35 or over, the predicted rate goes up to 11. A similar figure is predicted if the only difference is that it is the first birth. For a mother still aged 20-24 and parity 1 but from an unskilled manual/unemployed background the rate is 13.5. A combination of age 35 or over and parity 3 or more, for someone in the farmer, professional or other non-manual socio-economic groups, raises the rate to 15. Much higher rates are predicted, though, for those in the unskilled manual/unemployeed group where the mother is either aged 35 or over, parity is 3 or more, or both. For someone in that group aged 35 or over but parity less than 3, the predicted rate is 26.5; when parity is also 3 or more, the rate is as high as 36.

Table 5: Predicted Perinatal Mortality Rates by Characteristics

Characteristic	Predicted Perinatal Mortality Rate
benchmark (age 20-34, parity 1 or 2, farmer/professional/inter. non-manual)	8.0
As benchmark except:	
age 35 or over	10.9
parity 0	11.5
parity 3 or more	11.1
skilled/semi-skilled manual	8.66
unskilled/unemployed	13.5
age 35 or over + parity 3 or more	15.0
age 35 or over and unskilled/ unemployed	26.5
age 35 or over, parity 3 or more, unskilled/unemployed	36.2

Note: predicted from model (3), Table 4.

This analysis of the factors associated with perinatal mortality has therefore allowed us to go beyond the gross relationships between high risk and mother's age, parity and socio-economic background. The results show clearly that controlling for the other two, each of these factors has a statistically significant impact on the risk of perinatal mortality. For women in the non-manual or farmers socio-economic groups and with 1 or 2 previous births, being age 35 or over raises the risk of perinatal mortality by about 40%. A similar increase in risk is seen for a woman aged 20-34 in those groups comparing a the first birth **or** parity of 3 or more with second/third birth. Being in the unskilled manual/unemployed group in itself raises the risk for a woman aged 20-34 having her second or third child by about 70%. However, it is the combination of membership of this socio-economic group with age and parity effects which results in dramatically higher risks. For someone in the unskilled manual/unemployed group where the mother is aged 35 or over, the risk is over three times as high as for younger mothers in other socio-economic groups. The analysis, by allowing the separate and joint effects of these variables to be seen, highlights the combination of characteristics where very high perinatal mortality rates are seen.

3. Low Birthweight

Perinatal deaths occur relatively rarely in developed countries such as Ireland. The factors associated with relatively high risk of perinatal mortality may however have wider-ranging effects on health outcomes. The information provided by the perinatal reporting system includes birthweight, allowing the analysis to be extended beyond perinatal mortality to low birthweight, which has been shown to be an important influence on health in childhood and later life.[12] The conventional cut-off for defining low birthweight, of 2,500 grammes or under, is employed. The low birthweight rate is defined as the number of live births of this weight relative to the total number of live births (whereas for the perinatal mortality rate the denominator is the total live plus stillbirths). The total number of singleton live births for the 1984-88 period (on which we have full information) was 253,346, of which 8,700 weighted 2,500 grammes or less. The low birthweight rate per 1,000 was therefore 34.3. The fact that this is over four times as high as the perinatal mortality rate increases the power of the statistical analysis to distinguish the effects of the independent variables.

First, the way in which the low birthweight rate varies with each of mother's age, parity and socio-economic group is shown in Table 6. As was the case for perinatal mortality, the low birthweight rate is relatively high for mothers aged under 20 or 35 or over, for parity 1 or 3+, and for the unskilled manual/unemployed socio-economic group. There are some differences though. Compared with the overall average of 34, the low birthweight rate for mothers aged under 20 is 60 (though these constitute only a small proportion of all births). For the much larger number giving birth aged 35 or over the rate is 40, lower than that for the youngest age

[12] These effects can extend beyond physical health status to learning disabilities and emotional problems for those without serious physical handicap - see Chaikand and Corman (1991).

Table 6: Low Birthweight Rate per 1,000 by Mother's Age, Parity and Socio-Economic Group, Ireland 1984-88

A/ : Low Birthweight Rate by Mother's Age

age	live births	< 2,500 grammes	low birthweight rate (per 1000)
under 20	4116	246	59.77
20-24	42764	1602	37.46
25-34	160640	5034	31.34
35 and over	45826	1818	39.67
all	253,346	8700	34.34

B/ : Low Birthweight Rate by Parity

number of previous births	live births	< 2,500 grammes	low birthweight rate (per 1000)
0	64420	2927	45.44
1	69301	1948	28.11
2	51158	1358	26.54
3 and over	68467	2467	36.03
all	253,346	8700	34.34

C/ : Low Birthweight Rate by Socio-economic Group

Socio-economic group	live births	< 2,500 grammes	low birthweight rate (per 1,000)
farmers/farm labourers	33232	956	28.77
professional	22777	607	26.65
other non-manual	87552	2936	33.53
skilled/semi-skilled manual	82512	2875	34.84
unskilled manual/unemployed	27273	1326	48.62
all	255202	2900	34.34

group though still well above average. For perinatal mortality, by contrast, the rate for the under-20s was considerably lower than that for the over-34s. Similarly, in terms of parity it is those with no previous births who have a particularly high low birthweight rate of 45, whereas those with 3 or more previous births have a rate of 36, just above average: for perinatal mortality it was again those with 3 or more previous births who had the highest rates. Focusing on socio-economic background, the unskilled manual/unemployed group has a low birthweight rate of 48, well above average. The increase compared with the average is only about one-third, though, whereas in the case of perinatal mortality the rate for this group was over two-thirds above the average.

Again, going beyond the gross averages to two- and three-way cross-tabulations is informative. Appendix Table 2 shows the full three-way cross-classification of low birthweight by mother's age, parity and socio-economic group. This reveals, inter alia, that the rate for the under 20s is consistently higher than for other age categories, within socio-economic groups (almost all being parity 0). Likewise, the rate for the unskilled manual/unemployed group is consistently high within age and parity categories. It is most informative, though, to combine this with statistical analysis at individual level. The logit model is once again estimated, with the same independent variables as in the analysis of perinatal mortality, and the key results are shown in Table 7.

The estimated model including main effects only is shown in Col. (1). All the main effects are significant with the exception of age 25-34, which simply means that there is no difference between that and the omitted age category 20-24. The other variables are all significant with the expected sign : being aged under 20 or 35 or over, parity 0 or 3+, and being in the other non-manual, skilled/semi-skilled or unskilled/unemployed groups all increase the probability of low birthweight, while parity 2 and being in the professional/managerial group reduce it, compared with the omitted categories. In terms of the size of these effects, parity 0 and membership of the unskilled/unemployed group have the largest impact.

Extensive testing of possible interaction effects was carried out. The results showed that, whereas for perinatal mortality age/occupation interactions were important, in the case of low birthweight it was age/parity and occupation/parity interactions which added most to the explanatory power of the equation. As col. (2) of Table 7 shows, a number of such terms were significant, as was one age/occupation term. (The main effects term for age 25-34 remained insignificant and has been dropped from the equation).

Once again, the magnitude of the estimated effects can be seen by comparing the predicted low birthweight rate for different combinations of characteristics, as seen in table 8.

Table 7: Estimation Results for Logit Model, Low Birthweight

independent variable	Model (1) coefficient (t-statistic)	Model (2) coefficient (t-statistic)
intercept	-3.75 (81.18)	-3.83 (91.76)
age under 20	0.31 (4.38)	0.33 (4.86)
age 25-34	-0.03 (0.87)	-
age 35 or over	0.28 (6.87)	0.53 (10.23)
parity 0	0.50 (16.81)	0.64 (13.69)
parity 2	-0.08 (2.29)	0.12 (1.53)
parity 3 or more	0.12 (3.81)	0.56 (5.52)
professional	-0.07 (1.42)	-0.09 (1.70)
other non-manual	0.18 (4.66)	0.24 (5.72)
skilled/semi-skilled manual	0.22 (5.85)	0.27 (6.25)
unskilled/ unemployed	0.58 (13.25)	0.55 (11.68)
age 25-34 + parity 2	-	-0.24 (2.87)
age 25-34 + parity 3 or more	-	-0.33 (3.30)
age 35 or over + parity 2	-	-0.34 (3.11)
age 35 or over + parity 3 or more	-	-0.75 (6.53)
inter. non-manual + parity 0	-	-0.20 (3.53)

Table 7 (cont.)

skilled/semi-skilled manual + parity 0	-	-0.14 (2.42)
unskilled/unemployed + age 35 or over	-	0.14 (1.76)
number of observations	253,346	253,346
log-likelihood	-37498	-37460
Chi-squared	763.75	840.68

Note: Omitted categories reflected in intercept are age 20-24,parity 1, farmers etc.

Table 8: Predicted Low Birthweight Rates by Characteristics

Characteristic	Predicted Low Birthweight Rate
benchmark (age 20-34, parity 1, farmer)	21.22
As benchmark except:	
age under 20	29.38
age 35 or over	35.45
parity 0	39.31
parity 3 or more	36.51
skilled/semi-skilled manual	27.55
unskilled/unemployed	36.15
age under 20 + parity 0	54.04
age 35 or over and unskilled/ unemployed	68.12
age under 20, parity 0, unskilled/unemployed	89.96

Note: predicted from model (2), Table 7.

The predicted low birthweight rate for the omitted categories is 21 per 1,000. Where the mother's age is under 20, this increases to 29, or when that age is 35 or more it increases to 35. The influence of parity is notable though: the fact that it is the woman's first birth is on its own enough to increase the low birthweight rate from the benchmark to 39. This is even more than the impact of being in the unskilled/unemployed socio-economic group, taken alone. Once again, however, it is when adverse characteristics are found together that the predicted rate is very high. A woman aged under 20 and having her first child faces a risk of 54 per 1,000, while a woman with the same characteristics and in the unskilled/unemployed socio-economic group has a predicted rate of 90. The variation in risk across groups in the population is therefore very wide: the risk for a woman with that combination of high-risk characteristics of having a low birthweight child is four and a half times higher than for a woman aged 20-34 having her second child and in the professional/managerial socio-economic group.

4. Conclusions

This paper has analysed the factors associated with perinatal mortality and low birthweight in Ireland, using data for the years 1984-88. Both perinatal mortality and low birthweight are relatively high for mothers aged under 20 or over 34, for those having their first child or with 3 or more previous births, and for those from the unskilled manual/unemployed socio-economic group. These factors are not independent, however - for example, a relatively high proportion of births to the unskilled manual/unemployed group are to mothers aged under 20 or over 34. To assess the contribution of the different factors and their interrelationships, logit models were estimated. The results showed statistically significant independent effects of age, parity and socio-economic background on both perinatal mortality and low birthweight. However, particularly high risks were faced by those combining several adverse factors. In the case of perinatal mortality, this was most pronounced for mothers aged 35 or over, with parity of 3 or more, and in the unskilled manual/unemployed group. For low birthweight, the combination of age under 20 and no previous birth with that socio-economic background was the most adverse. In each case the extent of the variation in risk from lowest to highest risk group was very substantial.

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Appendix Table 1: Perinatal Death Rate By Socio-economic Group, Mother's Age and Parity

A/ No Previous Births

	under 20	20-24	25-34	35 and over	all
farm	0	10.371	12.396	10.355	11.318
professional	0	11.876	8.621	19.231	9.678
other non-manual	7.916	9.993	10.409	20.814	10.697
skilled/semi-skilled	14.801	10.841	12.466	15.831	12.105
unskilled/ unemployed	23.399	18.761	36.471	33.557	26.045
all	13.988	11.467	12.170	17.744	12.309

B/ 1 Previous Birth

	under 20	20-24	25-34	35 and over	all
farm	11.111	8.240	7.426	8.368	7.730
professional	0	10.753	7.740	9.401	8.090
other non-manual	25.424	8.002	7.525	13.107	8.240
skilled/semi-skilled	5.618	8.601	8.168	10.482	8.384
unskilled/ unemployed	6.230	10.562	15.598	33.582	13.714
all	10.816	8.768	8.238	12.037	8.700

C/ 2 Previous Births

	under 20	20-24	25-34	35 and over	all
farm	0	8.811	7.754	10.669	8.442
professional	0	11.236	7.863	9.068	8.224
other non-manual	55.556	7.051	7.807	11.401	8.455
skilled/semi-skilled	0	11.170	9.040	15.165	10.066
unskilled/ unemployed	0	13.831	8.950	32.520	12.346
all	13.423	10.521	8.324	13.163	9.364

D/ 3 or More Previous Births

	under 20	20-24	25-34	35 and over	all
farm	0	10.309	12.550	12.449	12.452
professional	0	66.667	13.897	9.248	11.445
other non-manual	111.111	8.032	12.278	15.092	13.463
skilled/semi-skilled	0	12.007	11.340	16.828	13.431
unskilled/ unemployed	0	13.301	17.590	34.937	22.656
all	23.256	11.809	13.063	16.885	14.648

Appendix Table 2: Low Birthweight Rate By Socio-economic Group, Mother's Age and Parity

A/ No Previous Births

	under 20	20-24	25-34	35 and over	all
farm	46.809	41.231	40.715	61.012	42.888
professional	88.889	23.923	37.899	77.754	39.216
other non-manual	62.252	39.326	40.573	75.229	42.527
skilled/semi-skilled	63.374	44.542	43.992	75.697	46.233
unskilled/ unemployed	74.442	63.905	70.524	81.633	68.429
all	65.202	43.799	42.559	72.960	45.436

B/ 1 Previous Birth

	under 20	20-24	25-34	35 and over	all
farm	55.556	27.129	19.323	29.505	22.389
professional	0	21.680	17.838	35.419	20.168
other non-manual	42.918	28.230	26.788	45.010	28.699
skilled/semi-skilled	30.986	27.836	27.382	38.705	28.238
unskilled/ unemployed	74.766	35.348	39.874	76.628	41.337
all	49.358	29.032	25.879	40.746	28.109

C/ 2 Previous Births

	under 20	20-24	25-34	35 and over	all
farm	0	15.487	19.260	32.304	21.766
professional	0	56.818	19.746	23.295	21.299
other non-manual	57.143	29.601	22.393	32.523	24.828
skilled/semi-skilled	23.256	33.741	25.034	41.299	28.178
unskilled/ unemployed	17.857	39.777	34.245	58.577	37.764
all	27.211	33.022	23.704	34.937	26.545

D/ 3 or More Previous Births

	under 20	20-24	25-34	35 and over	all
farm	0	46.632	28.797	26.552	27.899
professional	0	133.33	25.785	19.882	22.815
other non-manual	0	64.646	34.398	37.883	36.624
skilled/semi-skilled	0	43.103	31.865	41.378	35.764
unskilled/ unemployed	153.850	50.000	44.592	57.420	49.075
all	47.619	51.831	34.211	37.223	36.032